PERFORMANCE CHARACTERISTICS OF A 6-K MULTIPLE JT HELIUM ADSORPTION CRYOCOOLER*

A. Sirbi, C.A. Lindensmith, D.L. Johnson, S. Elliott
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California, USA 91109

We present the work done at the Jet Propulsion Laboratory for a Helium Adsorption Cooler to produce continuous cooling power at a temperature around 6 K. The goal of this development is to be able to propose for future space mission a long lifetime, vibration free cooler, which can cover the temperature range 18 K to 5 K. No mechanical parts or check-valves are involved in this design; the cooler is driving only by heaters and a temperature controller. We discuss two different configurations: In the first configuration two charcoal compressors are connected via a Joule-Thomson (JT) valve and the helium gas is oscillated back and forth between the compressors. Multiple sets of these independent JT coolers are connected to a cold plate through gas gap heat switches and operate out of phase with each other to produce refrigeration with stable temperatures. The second configuration utilizes multiple compressors, each with its own JT, which are connected to each other through a single cold-end reservoir at the cold plate. Both configurations have the advantage of vibration free operation and because no mechanical systems are included in this design it gives the potential for long lifetime operation of the cooler. We present in this paper the test results and discuss the advantages for each design in terms of the cold end temperature and stability due to the switching of the charcoal compressors, the electrical power supply required by the charcoal compressors, and the cooling power available at the 18-K pre-cooling stage.

*This research was carried out at the Jet Propulsion Laboratory, California Institute of Technology under a contract with the National Aeronautics and Space Administration.

Dean Johnson
Jet Propulsion Laboratory
M/S 157-316
4800 Oak Grove Dr.
Pasadena, CA 91109

Phone (818) 354-1641
Fax (818) 393-4206

Prefer Oral Paper
Dean.L.Johnson@jpl.nasa.gov

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